SOLAR OBSERVATIONS

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SOLAR RADIATION OBSERVATIONS, DECEMBER 1938

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Measurements of solar radiant energy received at the surface of the earth are made at eight stations maintained by the Weather Bureau, and at nine cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Washington, D. C., Madison, Wis., Lincoln, Nebr.) and at the Blue Hill Observatory of Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau stations at Washington and Madison.

The geographic coordinates of the stations, and descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data, obtained up to the end of 1936, will be found in the MONTHLY WEATHER REVIEW, December 1937, pp. 415 to 441; further descriptions of instruments and methods are given in Weather Bureau Circular Q.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parenthesis). At Madison and Lincoln the observations are made with the Marvin pyrheliometer; at Washington and Blue Hill they are obtained with a recording thermopile, checked by observations with a Marvin pyrheliometer at Washington and with a Smithsonian silver disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 8 a. m. (75th meridian time) and at noon (local mean solar time).

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, their departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

Direct radiation intensities averaged considerably above normal for December at Madison, slightly above normal at Lincoln and Blue Hill, and close to normal at Washington.

Total solar and sky radiation was above normal at all stations for which normals have been computed with the exception of Washington, Madison, New York, Fresno, La Jolla, and Blue Hill. For the year eight stations showed an excess of radiation and an equal number a deficiency; Chicago having the largest departure above normal and Washington the largest departure below normal. The algebraic sum of all the percentage departures from normal for continental United States is slightly positive; for all stations, including San Juan and Fairbanks, about 2 percent positive.

Polarization measurements made on 3 days at Madison give a mean of 57 percent with a maximum of 60 percent on the 21st. Both of these values are slightly below the corresponding normals for the month; due partly, at least, to partial snow cover.

TABLE 1.—*Solar radiation intensities during December 1939*

[Gram-calories per minute per square centimeter of normal surface]

WASHINGTON, D. C.

Date	Sun's zenith distance										
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e	5.0	4.0	3.0	2.0	[1]1.0	2.0	3.0	4.0	5.0	e
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Dec. 1	4.17							0.74			3.00
Dec. 6	4.57	0.73	0.91	1.01	1.24			.97			3.81
Dec. 7	3.81	.71	.93	1.04	1.24						3.99
Dec. 13	2.49				1.22						2.26
Dec. 14	2.87		1.11	1.21							3.15
Dec. 15	2.06			.83	1.23			1.13	0.95	0.78	1.96
Dec. 16	1.88	.70	.90	1.04	1.17						2.62
Dec. 19	3.30	.81	.90	.98	1.07						2.74
Dec. 20	2.62				1.05						2.62
Dec. 22	2.87	.83	1.04	1.10	1.24						2.87
Dec. 28	1.07	.83	.97	1.14	1.31						.91
Means		**.77**	**.97**	**1.04**	**1.20**			**1.08**	**.95**	**.78**	
Departures		**−.01**	**+.06**	**−.01**	**−.03**			**−.09**	**+.04**	**−.01**	
MADISON, WIS.											
Dec. 13	1.96	1.07	1.12	1.26							2.62
Dec. 14	1.78	1.20	1.29	1.40							1.12
Dec. 21	2.62	1.10	1.20	1.32							2.36
Dec. 27	.74			1.30							.91
Means		**1.12**	**1.20**	**1.32**							
Departures		**+.15**	**+.11**	**+.10**							
LINCOLN, NEBR.											
Dec. 1	3.63								0.84	0.67	4.37
Dec. 3	3.15			1.20							2.74
Dec. 5	3.30								.97	.92	3.81
Dec. 6	4.17								1.15		3.63
Dec. 12	1.68				1.49				1.17	1.08	1.45
Dec. 13	1.60	1.06	1.12	1.28	1.52			1.31	1.13	.96	2.06
Dec. 17	1.88	.85	.89	1.29							1.93
Dec. 21	1.78	1.07	1.21	1.33	1.44						2.74
Dec. 28	1.19	.82									1.78
Dec. 29	.91	1.02	1.15	1.29	1.48						1.02
Dec. 30	1.07	.94	1.05	1.22							1.24
Means		**.99**	**1.11**	**1.28**	**1.49**			**1.31**	**1.05**	**.91**	
Departures		**+.03**	**+.01**	**+.04**	**+.09**			**+.11**	**−.02**	**−.05**	
BLUE HILL, MASS.											
Dec. 1	2.1	0.75	0.85	0.97	1.01		0.89	0.85			2.1
Dec. 2	1.0						1.33	1.27			1.0
Dec. 13	2.2	1.01	1.11	1.23	1.31		1.33	1.18			2.2
Dec. 14	2.2				1.39						2.6
Dec. 15	1.2				1.38		1.35				1.6
Dec. 22	2.2			1.15	1.25		1.17	.94			1.9
Dec. 23	1.2			1.29	1.28		1.20				1.3
Dec. 25	3.0			1.20	1.32		1.32	1.00			3.0
Dec. 26	1.3			1.20	1.30						1.8
Dec. 27	5.3			1.20	1.40		1.30	1.00			8.9
Means		(.88)	(.98)	**1.18**	**1.29**		**1.24**	**1.04**			
Departures		**.00**	**−.07**	**.00**	**−.07**		**−.04**	**−.09**			

[1] Extrapolated.

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